Machine Learning

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Some definitions of machine learning

Computational intelligence is intended to give machines the ability to learn from what they can observe of the surrounding environment, and then act as a consequence of what they learned.
What do we mean by machine? Any man-made device or system of devices:

- Robots;
- Cars;
- Home appliances;
- The electrical grid;
- The communicatios systems;
- Medical systems;
- ...

In general, any thing that can hold a processor (computer) inside and that is wanted to be autonomous.

Some definitons of machine learning

OK, but what in the world is *learning*?

- Learning can be viewed as a process where the input consists of any available **data**, from which **information** is extracted, and then **knowledge** is inferred from this information.

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Learning machines

OK, but how a machine can learn?

- They do not take decisions from OUR knowledge.
- They learn from data, fed to them in form of numbers

Example: Construct a machine that classifies between cows and horses from measuring their height and width.

- We represent each feature in a dimension of a space.
- We construct an algorithm that learns to split the points in the space depending on their class.

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An example


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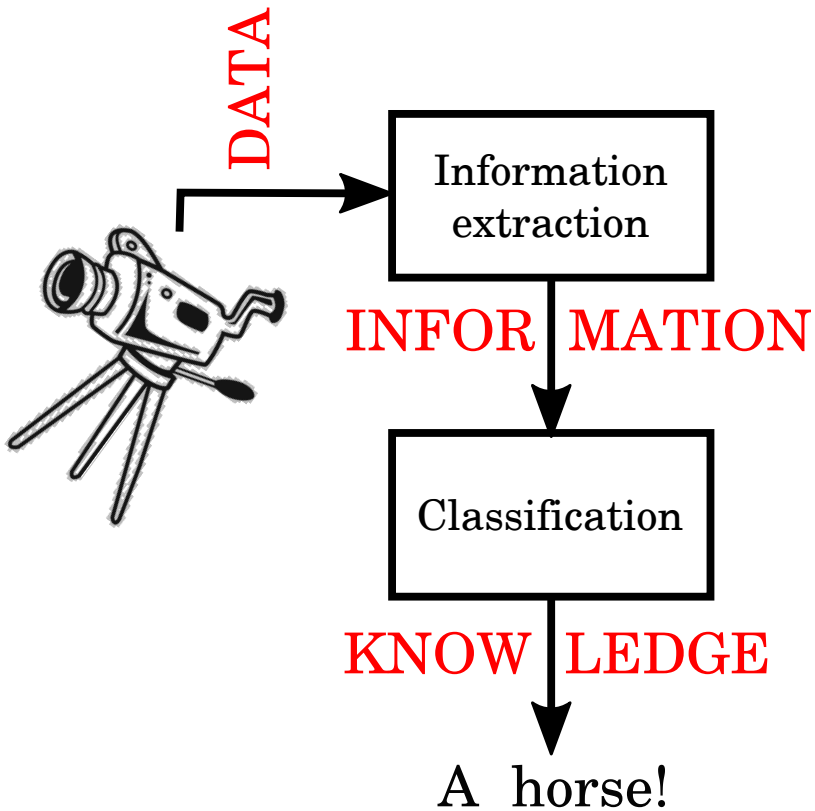
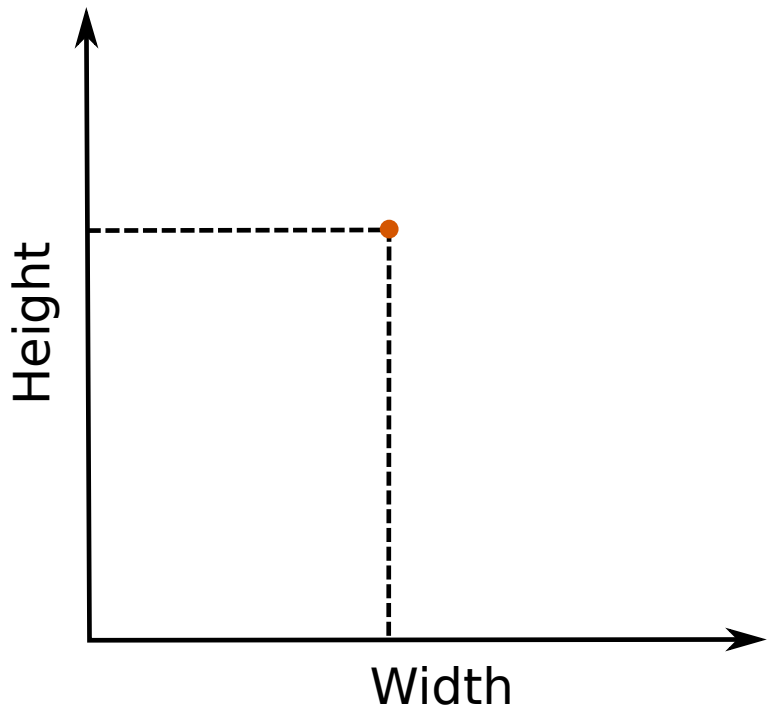

DATA
Information extraction
INFOR MATION
Classification
KNOW LEDGE
A horse!

An example

- The machine takes the height and width of each subject.

- The features are represented as a vector in the space.

$$\mathbf{x} = \begin{pmatrix} height \\ width \end{pmatrix}$$

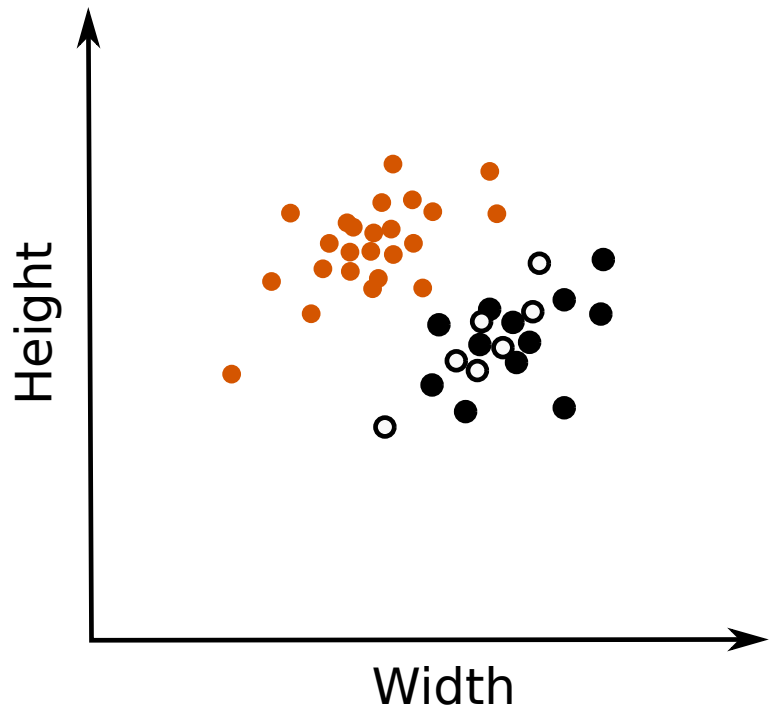


An example

We keep adding samples...

When we have a bunch of them, we an observe a structure in the space.

This is what the learning machine needs to discover.



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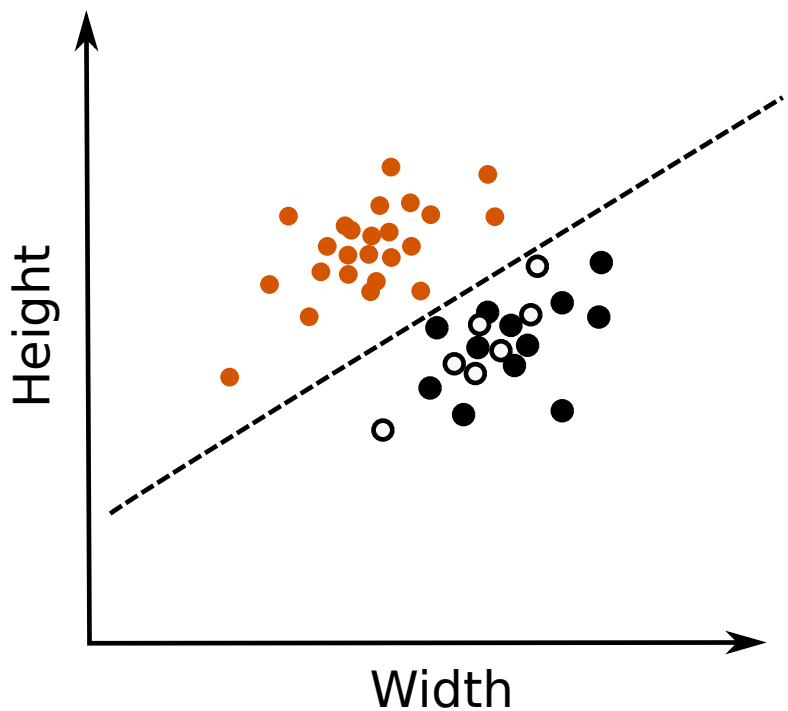
It can be done with a simple linear function.



Lesson outcomes

Main elements of this lesson:

- A definition of machine learning, with a definition of the processs data-information-knowledge.
- An example of learning machine, feature extraction, classification and associated notation.